Lab #2 – Small Scale Fading Measurements

Objectives:

- To characterize a multipath environment by performing a series of received power measurements
- To gain familiarity with programming the CC3200 WiFi Launchpad using the Energia IDE

In this lab you will observe the effects of small scale fading by perform a series of received signal power measurements.

The equipment you will be using for this lab is the CC3200 WiFi Launchpad from Texas Instrument, operating in the 2.4 to 2.5 GHz unlicensed band. The programming of the Launchpad will be done using Energia, which is an open source software platform based on the same one used for Arduino. If you have used Arduino before, then the interface will have a familiar look and feel.

You will program the Launchpad to act as a receiver. The Received Signal Strength Indicator (RSSI) in the CC3200 will measure the received power, and you will display the reading using the Energia's serial monitor on your PC.

For the WiFi transmitter, consider using your own router, or using the virtual router software from Lab 1. A third option (if available) is to borrow a second CC3200 Launchpad, and set that up to broadcast a SSID.

Recall that Rayleigh fading is the case where there are multiple copies of the transmitted signal arriving at the receiver, none of which is dominant. **Design** an experiment which will allow you to characterize the multipath environment, by performing a series of received signal strength measurements.

After collecting the measurements, plot a histogram of the received signal strength by using the software of your choice (Matlab is one possible option). Comment on your measurements and results.

Preparation for this Lab

1. Sign out a CC3200 Launchpad from the instructor. Your future earnings will be garnished if you do not return this board.
2. Download and install Energia onto your laptop

   http://www.energia.nu/

3. Connect the Launchpad, start Energia, and go through the proper configuration to make sure that you can program the Launchpad (Appendix 1).
4. Understand how to use the Energia serial monitor to communicate with your Launchpad (Appendix 2).
5. Review the Energia WiFi library, and understand how to program the Launchpad to connect to a WiFi network, as well as retrieving the RSSI reading (Appendix 3).
6. Design the experiment and outline the steps you will take.

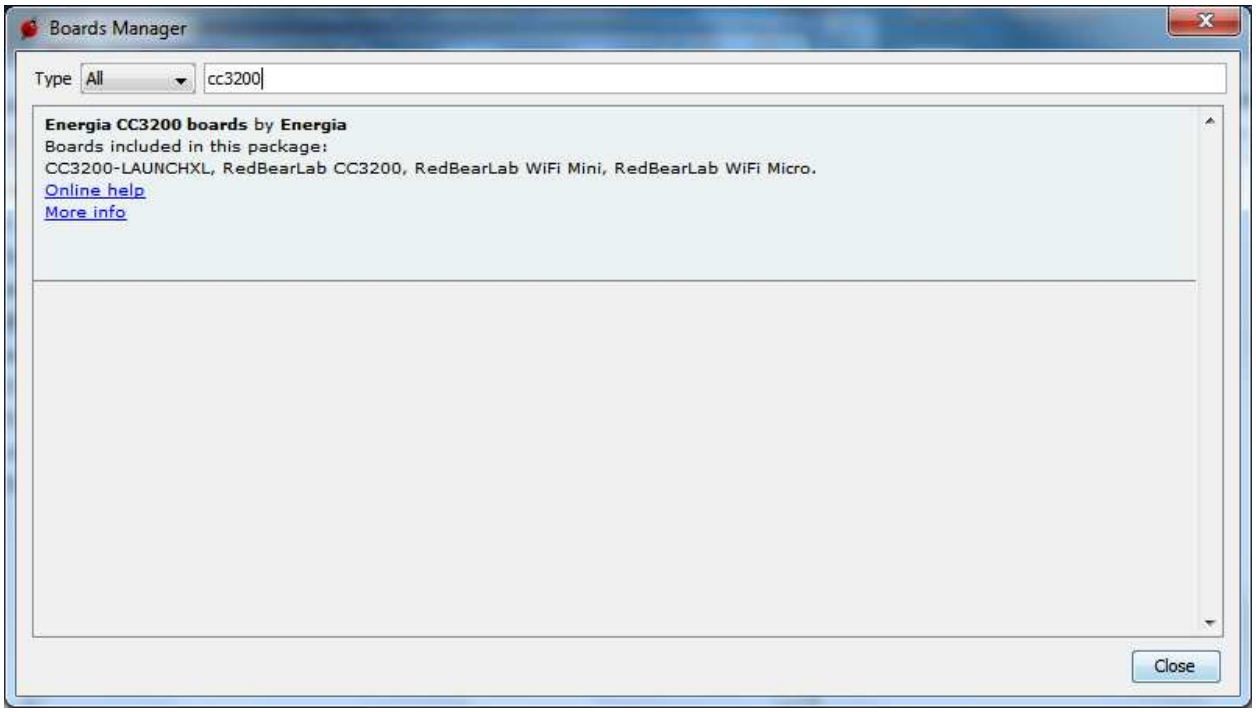
Submit report to D2L dropbox as noted on lab schedule

Appendix

1. The Energia and CC3200 Setup

Note: the instructions below have been updated for Energia v18, which introduces the ***Board Manager*** *for the first time to install device drivers*

Using the CC3200 Launchpad with Energia, **there are some jumpers that need to be set**. In addition, if you are using this for the first time, go to **Tools → Board → Board Manager** to install the device driver.

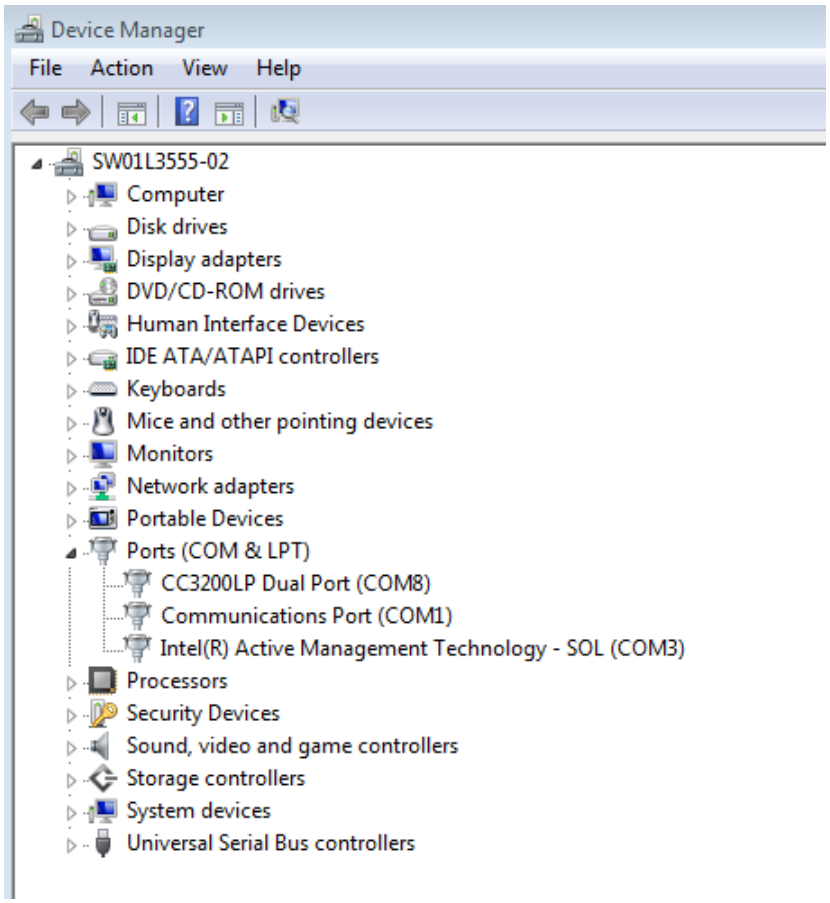


Refer to the following links for details on configuring the jumper wire:

http://energia.nu/cc3200guide/

http://energia.nu/pin-maps/guide_cc3200launchpad/

After starting Energia with the Launchpad connected to your PC, go to **Tools → Board** and make sure that the correct board is selected. Then, go to **Tools → Serial Port** and check that the correct COM port is selected; device manager will show which COM port your Launchpad is connected to.



A simple test to check that Energia can program your Launchpad is the upload the Blink example, provided in **File → Examples → Basics → Blink**.

2. The Energia Serial Monitor

The serial monitor can be started by going to **Tools → Serial Monitor**, or by clicking the following icon in the Energia front panel.

The following functions will be useful for communicating with the serial monitor:

Serial.begin (baud_rate)

Serial.available ( )

Serial.print (“string”)

Serial.println (“string”)

For more details, please refer to http://energia.nu/reference/serial/

3. WiFi Library

Energia includes a C++ library which allows you to program the WiFi resources on the CC3200 Launchpad. A reference for the library functions can be found at the following link.

http://energia.nu/reference/wifi/

I have found this documentation to be a starting point, but it is an incomplete list of what is available. For those interested in digging deeper, you can look directly at the C++ header file located at:

your_path\energia-0101E001x\hardware\cc3200\libraries\WiFi

To use the library functions, you will need to include the WiFi header file at the top of your Energia script:

#include <WiFi.h>

The following functions will be useful for this lab:

WiFi.begin (wifi_name, wifi_password)

WiFi.status ( )

WiFi.RSSI ( )

For this lab, program the CC3200 Launchpad to do the following:

- Connect to the specified WiFi network and examined the assigned IP address
- In a loop, read the received signal power using the **WiFi.RSSI** function. Add a delay between each reading (eg. Half a second to one second). You may want to check the status flag between readings using the **WiFi.status** function to make sure that the Launchpad remains connected to the access point.